Relationship between Volatile Organic Compounds (VOCs) in exhaled breath determined by Proton Transfer Reaction Time of Flight Mass Spectrometry (PTR-TOF-MS), clinical characteristics and airway inflammation in COPD

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Background

- Chronic obstructive pulmonary disease (COPD) is a heterogeneous condition.
- Breathomics presents an opportunity to phenotype this heterogeneity.
- How breath volatile organic compounds (VOCs) relate to clinical features of disease, airway physiology and inflammation is uncertain.

Methods

- Single centre prospective study; moderate to severe COPD.
- 35 COPD subjects, 379 breath samples collected using Reciva (figure 1).
- Proton Transfer Reaction-Time Flight Mass Spectrometry used (PTR-MS).
- Breathomic data analysed using PLS-DA model and receiver-operator characteristic (ROC) curves generated.
- Profiles associated with spirometry, lung volumes, gas transfer, symptoms (mMRC and CAT questionnaires), sputum eosinophils (< versus ≥1%) and neutrophils (< versus ≥61%).

Results

- Clinical characteristics were as shown Table 1.
- No distinct VOC breath profiles associated with airway physiology or symptoms.
- Sputum eosinophil and neutrophil cut-offs did identify distinct profiles with a ROC area-under-the-curve (95% confidence intervals) 0.84 (0.77-0.86) and 0.80 (0.69-0.81) respectively. Figure 2 ROC curve for sputum Neutrophils. Figure 3 ROC curve for sputum eosinophils.

Table 1: Clinical characteristics

Age years (range) n = 80		70 (66-74)
Female, n (%)		23 (28.75)
Caucasian, n (%)		80 (100)
Current smoker, n (%)		7 (8.75)
Pack years (SD)		45.89(30.09)
BMI, kg/m2 (SD)		27.74 (6.32)
FEV1 % predicted (SE)		55.00 (2.25)
Gold Stage	I, n (%)	21 (26.25)
	II, n (%)	30 (27.50)
	III, n (%)	22 (27.50)
	IV, n (%)	7 (8.75)
MRC score (SE)		2.6 (0.06)
SGRQ score (SE)		45.60 (1.21)
CAT score (SE)		19 (0.49)
Sputum eosinophils % (SE)		5.13 (0.73)
Sputum neutrophils % (SE)		73.39 (1.66)

Figure 1: ReCiva device

Conclusion

Machine Learning outcomes are partially able to relate VOC breath profiles to inflammation but not clinical characteristics.

Figure 2: ROC curve derived from breathome to discriminate between sputum neutrophils high vs low (AUROC = 0.7985)

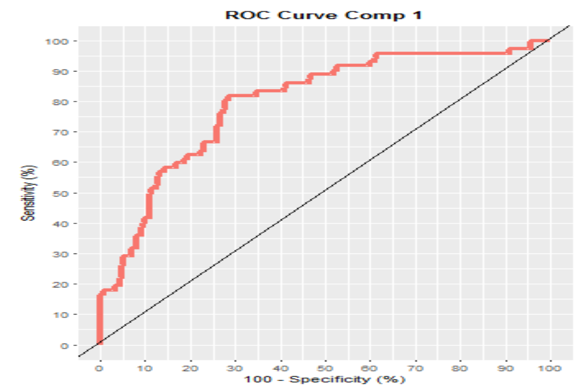

Figure 3: ROC curve derived from breathome to discriminate between sputum eosinophil high vs low (AUROC = 0.8432)